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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): M. Dajer et al.
Case: 9-3-29
Serial No.: 09/420,275
Filing Date: October 18, 1999
Group: 2682
Examiner: Eliseo Ramos-Feliciano

Title: Multi-Carrier/Multi-Sector Channel Pooling in a Wireless Communication System Base Station

I hereby certify that this paper is being deposited on this date with the U.S. Postal Service as first class mail addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature: Linda M. Hanli Date: September 2, 2003

APPEAL BRIEF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants hereby appeal the final rejection dated March 26, 2003 of claims 1-27 of the above-identified application.

REAL PARTY IN INTEREST

The present application is assigned to Lucent Technologies Inc., as evidenced by an assignment recorded December 29, 1999 in the U.S. Patent and Trademark Office at Reel 010464, Frame 0625. The assignee Lucent Technologies Inc. is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no known related appeals or interferences.

STATUS OF CLAIMS

The present application was filed on October 18, 1999 with claims 1-18. New claims 19-27 were added in a Preliminary Amendment filed by Applicants on August 30, 2000. Claims 1-27 are currently pending. Claims 1, 8, 15-19 and 24 are the independent claims.

Each of claims 1-27 stands finally rejected under 35 U.S.C. §102(e) or §103(a). Claims 1-27 are appealed.

STATUS OF AMENDMENTS

There have been no amendments filed subsequent to the final rejection.

SUMMARY OF INVENTION

The present invention is generally directed to multi-carrier channel pooling arrangements in which channel elements of a channel unit board of a base station are assignable to each of a plurality of carriers of a wireless communication system.

FIG. 4 of the drawings shows an illustrative example of a channel unit board 200 configured to provide multi-carrier channel pooling in accordance with the invention, as is described at page 5, line 22 to page 7, line 11 of the specification.

The channel unit board 200 includes N channel elements 202-1, 202-2, . . . 202-N, also denoted CSM1 through CSMN, and a multi-carrier/multi-sector multiplexer 204. The multiplex 204 allows each of the channel elements 202-*j*, $j = 1, 2, \ldots N$, to be assigned to any carrier and sector available in the system backplane. The multiplexer 204 has inputs coupled to α, β and γ sector outputs from each of the channel elements 202-*j*. Each of the α, β and γ sector outputs in this embodiment includes I and Q signals for that sector. The multiplexer 204 can couple the sector outputs from the N channel elements to any one of up to N different carrier I/Q buses. The connection of α, β and γ sector outputs from each channel element 202-*j* to particular channel buses is determined by a multiplexer control signal applied to the multiplexer 204.

This multi-carrier channel pooling arrangement is distinct from the conventional single-carrier channel pooling arrangements of the prior art. The latter arrangements are described at page 1, line 24 to page 4, line 8 of the specification, in conjunction with FIGS. 1 to 3 of the drawings. The

multi-carrier channel pooling arrangement in the illustrative embodiment of FIG. 4 provides numerous advantages relative to conventional single-carrier channel pooling, as is described as follows in the specification at page 8, lines 14-24, with emphasis supplied:

> Advantageously, the above-described multi-carrier/multi-sector channel pooling arrangement provides substantially improved flexibility relative to the conventional single-carrier/multi-sector approach. More particularly, the channel pooling of the present invention allows any channel element to be assigned to any carrier sector in the system. For example, the channel pooling of the present invention can allow all the channel elements of a given channel unit board to be assigned to a single carrier, or each channel element to be assigned to a different one of K carriers, where K ≤N, or any of a number of other combinations. The invention can thus allow a given base station design to support different wireless communication standards using the same base station hardware. The invention also protects the investments of base station equipment purchasers, by allowing existing equipment to be easily and efficiently upgraded to provide additional capacity, or to support changes in operating standards.

The multi-carrier channel pooling of the present invention thus represents a significant advance over conventional single-carrier channel pooling.

ISSUES PRESENTED FOR REVIEW

1. Whether claims 1-5, 7-12, 14, 15, 17 and 18 are anticipated under 35 U.S.C. §102(e) by U.S. Patent No. 6,400,966 (hereinafter "Andersson").

2. Whether claims 6, 13, 16 and 19-27 are unpatentable under 35 U.S.C. §103(a) over Andersson in view of unspecified "knowledge generally available to one of ordinary skill in the art."

GROUPING OF CLAIMS

With regard to Issue 1, claims 1, 2, 3, 7-10 and 13-15 stand or fall together, claims 4 and 11 stand or fall together, claims 5 and 12 stand or fall together, claim 17 stands or falls alone, and claim 18 stands or falls alone.

With regard to Issue 2, claims 6, 13, 19, 21, 23-25 and 27 stand or fall together, claim 16 stands or falls alone, claim 20 stands or falls alone, and claims 22 and 26 stand or fall together.

ARGUMENT

Issue 1

Applicants initially note that MPEP §2131 specifies that a given claim is anticipated "only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference," citing Verdegaal Bros. v. Union Oil Co. of California, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). Moreover, MPEP §2131 indicates that the cited reference must show the "identical invention . . . in as complete detail as is contained in the . . . claim," citing Richardson v. Suzuki Motor Co., 868 F.2d 1226, 1236, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Applicants respectfully traverse the §102(e) rejection on the ground that Andersson fails to teach or suggest each and every limitation of at least independent claims 1, 8 and 15, as will be described in greater detail below.

With regard to claim 1, this claim is directed to a wireless communication system base station having a plurality of channel unit boards. Each of the channel unit boards includes a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system. In addition, the claim specifies that each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system.

The present invention as set forth in claim 1 is directed to a type of multi-carrier channel pooling arrangement which is distinct from the conventional single-carrier channel pooling arrangements of the prior art. As indicated above, the claimed arrangement can be configured in an illustrative embodiment to provide numerous advantages relative to conventional single-carrier

channel pooling, such as improved flexibility and an enhanced ability to support multiple wireless communication standards using the same base station hardware.

The Examiner has asserted at page 6, section 8 of the final Office Action that Applicants in discussing the above-noted illustrative embodiment are relying upon features that are "not recited in the rejected claim(s)." Applicants wish to point out that they are simply providing the discussion of the illustrative embodiment in order to show an example of one possible implementation of the invention that meets the limitations of claim 1, so that the Examiner can better understand what those limitations mean.

The argument advanced by Applicants does not rely in any way on the details of the illustrative embodiment. As was indicated above and will be described in further detail below, what Applicants are arguing with regard to claim 1 is that Andersson fails to teach or suggest an arrangement in which each of the channel unit boards includes a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system, and each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system.

The Examiner in formulating the §102(e) rejection of claim 1 argues that these limitations of claim 1 are disclosed by the Andersson reference. More particularly, the Examiner argues with reference to FIG. 9A of Andersson that the claimed channel unit boards correspond to the elements BBTX-1, BBTX-2, . . . BBTX-N, and the claimed channel elements correspond to the resources within a given one of the BBTX units (Final Office Action, page 3, section 4). Applicants respectfully disagree. As noted above, in the present invention as set forth in claim 1, each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system. This limitation is not met in the portion of Andersson relied upon by the Examiner. For example, none of the resources in a given one of the BBTX units in Andersson FIG. 9A is assignable to each of a plurality of carriers of the system, as required by the express limitations of claim 1. Instead, a given one of these resources is associated with only one of the carriers of the system. This is apparent from FIG. 9A itself, which shows a different set of resources 1 through M6 being associated with each of the carriers 1 through N1. Moreover, the

associated description at column 10, lines 14-15 specifically states as follows, with emphasis supplied:

> In FIG. 9A, the BBTX hardware sub-unit (216) has a separate pool of BBTX resources for each carrier.

This is clearly a type of conventional single-carrier channel pooling, and fails to anticipate the multi-carrier channel pooling arrangement of claim 1.

The Examiner in the final Office Action at page 6, section 9 further argues with regard to claim 1 that the limitation specifying that "each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system" is "too broad." More specifically, the Examiner at page 6, section 9 states as follows:

> The claim language is too broad. How many are "at least a subset," or "at least one of the channel unit boards"? As explained above, Andersson et al. entirely meets this limitation.

Applicants respectfully submit that there can be no legitimate question as to "how many" constitute "at least a subset of the channel elements" or "at least one of the channel unit boards" in the limitation at issue. This language is absolutely clear and unambiguous on its face. The term "at least a subset of the channel elements" means any subset of the total set of channel elements, or in other words, one or more of the channel elements. The term "at least one of the channel unit boards" similarly means one or more of the channel unit boards. Applicants submit that one cannot reasonably question "how many" of the various elements are referred to in view of this clear and unambiguous language.

Moreover, as noted above, the limitation of claim 1 specifying that "each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system" is not met by Andersson. This limitation in effect requires that there be at least one channel element of at least one of the channel unit boards that is assignable to each of

multiple carriers of the system. The resources Resource-1, . . . Resource-M_6 of BBTX 1 in FIG. 9A of Andersson, relied upon by the Examiner at page 6, section 9 of the final Office Action, are simply not assignable to each of multiple carriers of the system. Instead, as indicated previously herein and as is readily apparent from FIG. 9A, each of the carriers Carrier 1, . . . Carrier N1 has its own such set of resources Resource-1, . . . Resource-M_6.

Applicants therefore submit that independent claim 1 is not anticipated by Andersson. Dependent claims 2-7 are believed allowable for at least the reasons identified above with regard to claim 1.

With regard to independent claims 8 and 15, each of these claims includes limitations similar to those of claim 1, and is believed to be allowable for substantially the reasons identified above with regard to claim 1. Dependent claims 9-14 are believed allowable at least by virtue of their dependence from claim 8.

With regard to dependent claims 4 and 11, each of these claims specifies that I and Q signals generated for a given one of the carriers by a given one of the channel unit boards are combined within another of the channel units boards with the I and Q signals generated for the given carrier by the other channel unit board. This particular channel unit board arrangement is not taught or suggested by Andersson.

With regard to dependent claims 5 and 12, each of these claims specifies that each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system. Again, such an arrangement is not shown or suggested by Andersson.

With regard to independent claim 17, this claim includes a limitation relating to the provision of a multi-carrier channel pooling arrangement. More specifically, this claim recites a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system, and a multiplexer operative to assign signals from at least a subset of the channel elements to each of a plurality of carriers of the system, so as to implement a multi-carrier channel pooling arrangement. As indicated above, the BBTX units of the Andersson reference, specifically relied upon by the Examiner in formulating the §102(e) rejection, are not configured to provide a multi-carrier channel pooling arrangement. Instead, the BBTX units of Andersson are

disclosed as providing a single-carrier channel pooling arrangement which includes "a separate pool of BBTX resources for each carrier" (Andersson, column 10, lines 14-15).

With regard to independent claim 18, this claim is directed to a method which includes the step of controllably assigning channel elements to designated ones of the plurality of carriers of the system, so as to implement a multi-carrier channel pooling arrangement. For substantially the same reasons described above, this claim is believed to define patentable subject matter over the single-carrier channel pooling arrangement of Andersson.

Issue 2

The arguments presented with regard to Issue 1 above are hereby realleged and incorporated by reference herein. It is respectfully submitted that the unspecified "knowledge generally available to one of ordinary skill in the art" cited by the Examiner fails to supplement the above-described fundamental deficiencies of the Andersson reference with regard to the claimed multi-carrier channel pooling arrangements.

With regard to claims 6 and 13, these claims are believed allowable for at least the reasons identified above with regard to their respective independent claims.

With regard to claims 19, 21, 23-25 and 27, independent claims 19 and 24 each include limitations not taught or suggested by the proposed combination of Andersson and the unspecified "knowledge generally available to one of ordinary skill in the art."

For example, claim 19 calls for a base station having a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals transmitted by the system, and a controllable signal combiner element coupled to at least a subset of the plurality of channel unit boards. The controllable signal combiner element implements an assignment of signals from each of at least a subset of the channel elements of a given one of the channel unit boards for transmission on one or more of a plurality of carriers of the system. The Examiner again relies on the BBTX units of Andersson as meeting the claimed channel unit boards (Final Office Action, page 5, fifth paragraph). As indicated above, the BBTX units of the Andersson reference are disclosed as providing a single-carrier channel pooling arrangement which includes "a separate

pool of BBTX resources for each carrier" (Andersson, column 10, lines 14-15), and thus the proposed combination fails to meet the limitations of claim 19.

Dependent claims 20-23 are believed allowable for at least the reasons identified above with regard to claim 19.

Claim 24 is directed to a base station having a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals received by the system. The claim further calls for a controllable selector associated with a given one of the channel unit boards and receiving as inputs a set of signals associated with a receive bus of the system, the controllable selector having a plurality of outputs, each coupled to a corresponding input of one of the channel elements of the given channel unit board. In addition, the controllable selector implements an assignment of received signals from each of a plurality of carriers of the system to each of at least a subset of the channel elements of the given channel unit board. The Examiner relies upon the arguments advanced with regard to claim 19 (Final Office Action, page 5, last paragraph). However, as indicated above, the arguments advanced with regard to claim 19 rely on the BBTX units of Andersson, and the proposed combination thus fails to teach or suggest a multi-carrier channel pooling arrangement of the type claimed.

Dependent claims 25-27 are believed allowable for at least the reasons identified above with regard to claim 24.

With regard to independent claim 16, this claim includes limitations similar to those of claim 1, and is believed to be allowable for substantially the reasons identified above with regard to claim 1.

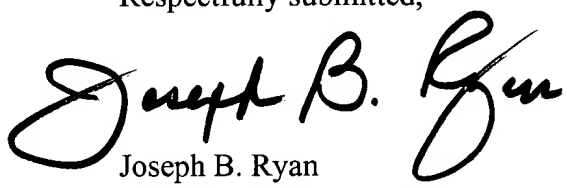
With regard to dependent claim 20, this claim further specifies that the controllable signal combiner element of claim 19 includes a set of controllable signal combiners associated with a given one of the channel unit boards and each having a plurality of inputs, with each of the inputs coupled to an output of a particular one of the plurality of channel elements of the given channel unit board, and a multi-carrier combiner having a plurality of inputs, with each of the inputs coupled to an output of a corresponding one of the controllable signal combiners, the multi-carrier combiner further having an additional input coupled to a bus output of another of the plurality of channel unit boards,

and generating a set of outputs on a system transmit bus. The set of controllable signal combiners and multi-carrier combiner are not taught or suggested by the proposed combination.

With regard to dependent claims 22 and 26, each of these claims specifies that each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system. This is a type of multi-carrier channel pooling which is not taught or suggested by the proposed combination.

In view of the above, Applicants believe that claims 1-27 are in condition for allowance, and respectfully request the withdrawal of the §102(e) and §103(a) rejections.

Respectfully submitted,



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APPENDIX

1. (Amended) A base station for use in a wireless communication system, comprising:

a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system, wherein each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system.

2. The base station of claim 1 wherein each of the channel unit boards generates a set of digital in-phase (I) and quadrature (Q) signals for each of the plurality of carriers.

3. The base station of claim 2 wherein at least one of the channel unit boards includes a multiplexer operative to connect a given one of the channel elements to an I and Q signal bus associated with a given one of the plurality of carriers.

4. The base station of claim 3 wherein the I and Q signals generated for a given one of the carriers by a given one of the channel unit boards is combined within another of the channel units boards with the I and Q signals generated for the given carrier by the other channel unit board.

5. The base station of claim 1 wherein each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system.

6. The base station of claim 1 further including a control computer operative to generate one or more control signals for controlling assignment of the channel elements of the channel unit boards to the plurality of carriers of the system.

7. The base station of claim 1 wherein the wireless communication system is a code division multiple access (CDMA) communication system operating in accordance with at least one of an IS-95A standard, an IS-95B standard, an IS-95C standard with Orthogonal Transmit Diversity (OTD), an IS-95C standard without OTD, a Multi-Carrier (MC) cdma2000 standard, and a Universal Mobile Telecommunications System (UMTS) standard.

8. A method of implementing a base station for use in a wireless communication system, the base station comprising a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals assigned to a plurality of carriers of the communication system, the method comprising the step of:

controllably assigning the channel elements of at least one of the channel unit boards to designated ones of the plurality of carriers of the system, such that different channel elements of the channel unit board are assigned to different carriers of the system.

9. The method of claim 8 wherein each of the channel unit boards generates a set of digital I and Q signals for each of the plurality of carriers.

10. The method of claim 9 wherein at least one of the channel unit boards includes a multiplexer operative to connect a given one of the channel elements to an I and Q signal bus associated with a given one of the plurality of carriers.

11. The method of claim 10 wherein the I and Q signals generated for a given one of the carriers by a given one of the channel unit boards is combined within another of the channel units boards with the I and Q signals generated for the given carrier by the other channel unit board.

12. The method of claim 8 wherein each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system.

13. The method of claim 8 wherein the assigning step is implemented at least in part using a control computer operative to generate one or more control signals for controlling assignment of the channel elements of the channel unit boards to the plurality of carriers of the system.

14. The method of claim 8 wherein the wireless communication system is a CDMA communication system operating in accordance with at least one of an IS-95A standard, an IS-95B standard, an IS-95C standard with OTD, an IS-95C standard without OTD, an MC cdma2000 standard, and a UMTS standard.

15. An article of manufacture comprising a machine-readable storage medium for storing one or more programs for use in configuring a base station of a wireless communication system, the base station comprising a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system, the one or more programs when executed implementing the step of:

controllably assigning the channel elements of at least one of the channel unit boards to designated ones of the plurality of carriers of the system, such that different channel elements of the channel unit board are assigned to different carriers of the system.

16. (Amended) A base station for use in a wireless communication system, comprising:

a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system, wherein each of at least a subset of the channel elements of at least one of the channel unit boards is assignable to each of a plurality of carriers of the system; and

a control computer coupled to at least a subset of the plurality of channel unit boards, the control computer being operative to assign the channel elements of the channel unit boards to particular ones of the carriers of the system.

17. A base station for use in a wireless communication system, comprising:

a plurality of channel elements for providing processing operations for signals assigned to multiple carriers of the communication system; and

a multiplexer operative to assign signals from at least a subset of the channel elements to each of a plurality of carriers of the system, so as to implement a multi-carrier channel pooling arrangement.

18. A method of implementing a base station for use in a wireless communication system, the base station comprising a plurality of channel elements for providing processing operations for signals assigned to a plurality of carriers of the communication system, the method comprising the step of:

controllably assigning the channel elements to designated ones of the plurality of carriers of the system, so as to implement a multi-carrier channel pooling arrangement.

19. (New) A base station for use in a wireless communication system, comprising:

a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals transmitted by the system; and

a controllable signal combiner element coupled to at least a subset of the plurality of channel unit boards;

wherein the controllable signal combiner element implements an assignment of signals from each of at least a subset of the channel elements of a given one of the channel unit boards for transmission on one or more of a plurality of carriers of the system.--

20. (New) The base station of claim 19 wherein the controllable signal combiner element further comprises:

a set of controllable signal combiners associated with a given one of the channel unit boards and each having a plurality of inputs, with each of the inputs coupled to an output of a particular one of the plurality of channel elements of the given channel unit board; and

a multi-carrier combiner having a plurality of inputs, with each of the inputs coupled to an output of a corresponding one of the controllable signal combiners, the multi-carrier combiner further having an additional input coupled to a bus output of another of the plurality of channel unit boards, and generating a set of outputs on a system transmit bus.

21. (New) The base station of claim 19 wherein each of the channel unit boards generates a set of digital in-phase (I) and quadrature (Q) signals for each of the plurality of carriers.

22. (New) The base station of claim 19 wherein each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system.

23. (New) The base station of claim 19 further including a control computer operative to generate one or more control signals for application to the controllable signal combiners and the multi-carrier combiner so as to control assignment of each of at least a subset of the channel elements of the given channel unit board to one or more of the plurality of carriers of the system.

24. (New) A base station for use in a wireless communication system, comprising:

a plurality of channel unit boards each including a plurality of channel elements for providing processing operations for signals received by the system; and

a controllable selector associated with a given one of the channel unit boards and receiving as inputs a set of signals associated with a receive bus of the system, the controllable selector having a plurality of outputs, each coupled to a corresponding input of one of the channel elements of the given channel unit board;

wherein the controllable selector implements an assignment of received signals from each of a plurality of carriers of the system to each of at least a subset of the channel elements of the given channel unit board.

25. (New) The base station of claim 24 wherein each of the channel unit boards processes a set of digital in-phase (I) and quadrature (Q) signals for each of the plurality of carriers.

26. (New) The base station of claim 24 wherein each of at least a subset of the channel unit boards includes a total of N channel elements, and each of the channel elements may be assigned to one of up to N carriers of the system.

27. (New) The base station of claim 24 further including a control computer operative to generate one or more control signals for application to the controllable selector so as to control assignment of the received signals from each of the plurality of carriers of the system to each of at least a subset of the channel elements of the given channel unit board.